

**What is claimed is:**

1. A process for hydrogenating a polymer, which process comprises the steps of:

contacting a polymer solution containing an olefinic unsaturated group with hydrogen in the presence of a hydrogenation catalyst to hydrogenate the olefinic unsaturated group of the polymer; and

recycling at least one part of the resultant hydrogenated polymer solution for hydrogenation.

2. The process according to claim 1, wherein the polymer solution containing an olefinic unsaturated group is continuously supplied to a reactor to continuously hydrogenate the olefinic unsaturated group of the polymer, and the resultant hydrogenated polymer solution is continuously taken out from the reactor and then one part thereof is continuously recycled to the reactor for hydrogenation.

3. The process according to claim 2, wherein the hydrogen is supplied from near the bottom of the reactor.

4. The process according to claim 2, wherein the reactor is a tank reactor, the polymer solution containing an olefinic unsaturated group is supplied from near the top of the reactor, and the resultant hydrogenated polymer solution is taken out from near the bottom of the reactor or a piping arranged out of the reactor to recycle one part thereof to the reactor for hydrogenation.

5. The process according to claim 2, wherein the reactor is a tank reactor having an L/D of from 1 to 8 and being equipped with a stirrer wherein L represents a length between an upper tangent line and a lower tangent line of the reactor and D represents an inner diameter of the reactor.

6. The process according to claim 2, wherein the reactor is a column or tube reactor, and the polymer solution containing an olefinic unsaturated group is supplied from near the bottom of the reactor, and one part of the polymer solution

hydrogenated in the reactor is continuously taken out from near the top of the reactor or a piping arranged out of the reactor to recycle one part thereof to the reactor.

7. The process according to claim 1, wherein the hydrogenation catalyst is supplied two or more times to conduct hydrogenation.

8. The process according to claim 1, wherein a reactor group comprising two or more reactors connected in series is used, the polymer solution containing an olefinic unsaturated group is continuously supplied to the first reactor of the reactor group, the hydrogen is supplied to at least one reactor of the reactor group to continuously hydrogenate the olefinic unsaturated group of the polymer, and the resultant polymer solution hydrogenated in at least one reactor of the reactor group is continuously taken out to continuously recycle one part thereof to the reactor and/or a reactor arranged upstream of the reactor for hydrogenation.

9. The process according to claim 8, wherein the hydrogen is supplied from near the bottom of at least one reactor of the reactor group.

10. The process according to claim 8, wherein the first reactor is a tank reactor having an L/D of from 1 to 8 and being equipped with a stirrer, and the second and following reactors arranged downstream of the first reactor are at least one kind selected from the group consisting of a tank reactor having an L/D of from 1 to 8 and being equipped with a stirrer, a column reactor having an L/D of 2 or more and a tube reactor having an L/D of 2 or more.

11. The process according to claim 8, wherein the hydrogen catalyst is supplied to the first reactor and is additionally supplied to at least one of the reactors arranged downstream of the first reactor.

12. The process according to claim 2 or 8, wherein the continuous hydrogenation is initiated after the polymer

solution containing an olefinic unsaturated group is hydrogenated to a desirable degree of hydrogenation.

13. The process according to any one of claims 1 through 11, wherein a mass ratio between a polymer containing an olefinic unsaturated group to be supplied and the resultant hydrogenated polymer to be recycled is from 1/50 to 50/1.

14. The process according to claim 1, wherein a hydrogenation reaction is a batch type.

15. The process according to claim 14, wherein the hydrogenation catalyst is supplied two or more times.

16. The process according to claim 15, wherein timing of the second and following supply of the hydrogenation catalyst is decided by measuring an absorption rate of hydrogen.

17. The process for according to claim 16, wherein timing of the second and following supply is a time when the absorption rate of hydrogen decreases to 80% or less of an initial absorption rate of hydrogen at the beginning of hydrogenation reaction.

18. The process according to claim 15, wherein an amount of the first supply of hydrogenation catalyst is controlled so that a degree of hydrogenation at the time of the second and following supply is from 50% to 90%.

19. The process according to any one of claims 1 through 11 and 14 through 18, wherein the resultant hydrogenated polymer solution is recycled through a heat exchanger.

20. The process according to any one of claims 1, 7, 11, and 15 through 18, wherein the hydrogenation catalyst is a metallocene compound.